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NOTES ON NEW ENGLAND HEPATICAE,—V.

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(Plate 73.)

(Continued from p. 60.)

6. CALYPOGEIA SPHAGNICOLA (Arn. & Perss.) Warnst. & Loeske, Verhandl. Bot. Ver. Prov. Brandenburg 47: 320. 1905. *Kantia sphagnicola* Arn. & Perss. Rev. Bryol. 29: 26. f. 1-8. 1902. *Cincinnatiulus Trichomanis*, var. *sphagnicola* Meylan, Bull. de l'Herb. Boissier II. 6: 499. 1906. In tufts of *Dicranum Bergeri* growing in a bog; New Milford, Connecticut (A. W. E.). The present species was first described from Swedish specimens but has since been collected in Scotland, in Austria, in Switzerland, and apparently in northern Germany. The New England plants agree closely with the type material, and the writer's determination has been confirmed by Macvicar. *C. sphagnicola* is close to *C. Trichomanis* but differs from it in a number of respects and is apparently worthy of specific rank. Even when well developed it is a small species and is pale green in color, slightly tinged with yellow. The leaves are imbricated and spread from the axis at an angle of about 45 degrees, which is considerably less than in *C. Trichomanis*. They are distinctly convex, the apex being frequently revolute, and they are usually 0.85-1 mm. long and 0.6-0.7 mm. wide. The postical base is normally rounded and abruptly short-decurrent, and the apex varies from obtuse to rounded or slightly emarginate. The leaf-cells average about $40 \times 27 \mu$ and develop small but distinct trigones; these are usually triangular in outline with straight or concave sides but are sometimes

more nearly circular, the sides being convex. The orbicular or ovate-orbicular underleaves average about 0.35 mm. in length and give rise to a great abundance of long rhizoids. They are bifid to the middle or a little beyond with a blunt sinus and the divisions are erect or slightly divergent and obtusely pointed. In rare instances one of the divisions bears a blunt supplementary lobe on the outside. The inflorescence is described as autoicous. The small size of the plants, the angle at which the leaves spread, the distinct trigones, and the deeply bifid underleaves usually make it easy to distinguish the species from *C. Trichomanis*. Unfortunately etiolated stems are often developed in which the leaves are long-decurrent and the trigones scarcely apparent. Such stems might be the source of considerable confusion, if they were not always associated with normal stems in which the true characters of the species were well shown.

7. *CALYPOGEIA SUECICA* (Arn. & Perss.) C. Müll. Frib. Beih. zum Bot. Centralbl. **17**: 224. 1904. *Kantia suecica* Arn. & Perss. Rev. Bryol. **29**: 29. f. 1-6. 1902. *Cincinnulus suecicus* C. Müll. Frib. Beih. zum Bot. Centralbl. **13**: 98. 1902. *Cincinnulus Trichomanis*, var. *suecicus* Meylan, Bull. de l'Herb. Boissier II. **6**: 499. 1906. On rotten logs. Mt. Katahdin, Maine (*Cowles Party, 33*).¹ Stafford, Connecticut (*G. E. Nichols*). Since the original publication of this species from Swedish specimens it has been reported from Scotland, France, Germany, Austria and Switzerland. As in the case of *C. sphagnicola*, however, this is the first record for North America. The New England specimens have been compared with a portion of the type material with which they agree closely. *C. suecica* seems to be confined to rotten logs and is often found in company with such species as *Cephalozia lunulaefolia*, *Riccardia latifrons* and *Lophozia porphyroleuca*. It bears a strong resemblance to *C. Trichomanis* but is considerably smaller, being of about the same size as *C. sphagnicola*. The leaves are convex and occasionally revolute at the apex; they spread obliquely from the axis at about the same angle as in *C. Trichomanis* and therefore more widely than in *C. sphagnicola*. The leaves are triangular-ovate in outline and their apices are very variable, being normally rounded but frequently truncate or bidentate, both teeth and sinus varying from acute to rounded. The leaf-cells are small, averaging about 30 μ in diameter, and in the outer part of the leaf are characterized by distinct trigones, triangular in outline with

¹ Harvey (RHODORA **5**: 51. 1903) has listed these specimens as *Kantia Trichomanis* from an earlier determination by the writer.

straight or slightly convex sides. The underleaves are relatively large and frequently imbricated, averaging about 0.45 mm. in length and from 0.45–0.6 mm. in width. They are broadly orbicular and bifid to the middle or beyond with an acute sinus and acute or obtuse lobes. Sometimes the lobes are entire but it is more usual for them to bear a blunt supplementary tooth on the outside, and occasionally a second tooth of this character is to be observed. The inflorescence seems to be constantly dioicous. In distinguishing the species from *C. Trichomanis* the small size, the variable leaves, the small leaf-cells with trigones, and the deeply bifid underleaves afford the most trustworthy differential characters. The peculiar habitat of the plant should also be kept in mind.

8. CALYPOGEIA SULLIVANTII Aust. Hep. Bor.—Amer. 74b. 1873. *Kantia Sullivantii* Underw. Bot. Gaz. 14: 196. 1889. The type material of *C. Sullivantii* came from Alabama but the species was also known to Austin from New Jersey. It has since been recorded from Massachusetts, Rhode Island, and Connecticut and the writer has lately received specimens from North Carolina and Arkansas. It evidently replaces the European *C. arguta* in North America and is very different from the other species noted in the present paper. Since the published descriptions are incomplete, a fuller account of the species, with figures, may perhaps be of service.

The plants grow scattered or in very loose mats and vary in color from a pale yellowish green in exposed localities to a deeper green in the shade. The stems are prostrate and sparingly branched. They are somewhat flattened and show a distinction between the cortex, which is composed of a single layer of enlarged cells, and the median region, which is made up of a mass of smaller cells about four cells wide and three cells thick. The cortical cells are commonly arranged in ten longitudinal rows, four antical, four postical, and one lateral on each side (f. 3). The postical cells are a little larger than the antical, but the lateral cells surpass both in size, measuring from 45–70 μ in length and about 45 μ in width. They give the stem the appearance of being narrowly winged. The leaves are attached to these long cortical cells for about three fourths their width, the line of insertion curving at its apical end to the middle of the antical surface of the stem (f. 4). A similar stem-structure is found in *C. arguta* and also in the Hawaiian *C. bifurca* Aust.;¹ it bears a strong resemblance to the

¹ Proc. Acad. Nat. Sci. Phil. 1869: 223. See also C. M. Cooke, Jr., Trans. Conn. Acad. 12: 26. pl. 9, f. 1–10. 1904.

structure of the midrib in *Metzgeria* and in the remarkable South American genus *Pteropsiella* as described and figured by Spruce.¹

The leaves are usually small and rudimentary at the base of a stem or branch, then increase rapidly in size toward the middle and become smaller again toward the apex. They vary from distant to loosely imbricated and spread widely from the axis, sometimes at nearly a right angle. In the median region, where they are most normally developed, they are ovate to broadly ovate in outline, 0.75–1.2 mm. long, 0.6–0.85 mm. wide, and plane or nearly so. The postical margin is usually a little more curved than the antical and either meets the axis at a wide angle or is short-decurrent. The leaves gradually narrow out toward the apex, which is uniformly bidentate with sharp parallel teeth separated by an obtuse to lunulate sinus. The teeth are usually three or four cells long and two cells wide at the base, but these numbers are subject to some variation (*f.* 5, 6). The leaf-cells are large, averaging about $60 \times 40 \mu$, but there is usually a sharp contrast between them and the lateral cortical cells, since the long axes of the latter extend in a different direction. The walls of the cells are either thin throughout or uniformly thickened and do not show distinct trigones. The free walls on both leaf-surfaces are characterized by being minutely verruculose, the walls in the other New England species being smooth throughout.

The underleaves are distant and minute, measuring about 0.2 mm. in length and 0.25 mm. in width. They are sometimes appressed to the axis, sometimes more or less spreading and sometimes completely reflexed and give rise to a large number of long rhizoids. They are rectangular or trapezoidal in outline and deeply bifid with a lunulate sinus, the divisions being more or less divergent and acute. Each division is tipped with a hyaline papilla and bears a small and sharp tooth, also tipped with a papilla, on the outside. The underleaves are fairly definite in structure; each division is usually two or three cells wide at the base and three or four cells long, and the lateral tooth, which arises directly from the broad base, is usually composed of a single cell (*f.* 8). In the basal and apical regions of the stem the structure of the underleaves becomes somewhat simpler. The inflorescence in *C. Sullivantii* is dioicous but the sexual branches afford no differential characters of importance, and the perigynium and sporophyte are still unknown.

¹ Hep. Amaz. et And. 390. *pl.* 16. 1885.

The flattened stem with its distinct cortical layer, the bidentate leaves, the large leaf-cells with verruculose cuticle, and the minute underleaves with their sharp and unidentate divisions afford a combination of characters which will at once distinguish *C. Sullivantii* from all other known New England species. These peculiarities, however, are all shared by *C. arguta*, which, although European, has been reported from greenhouses in Philadelphia and is perhaps to be expected in similar localities elsewhere. *C. arguta* is distinguished mainly by the longer and more divergent teeth of its leaves, separated by a broader sinus.

9. ***Calypogeia tenuis*** (Aust.) spec. nov. *C. Trichomanis*, var. *tenuis* Aust. Hep. Bor.-Amer. 74. 1873. *Kantia Trichomanis*, var. *tenuis* Underw.; A. Gray, Manual, Ed. 6, 713. 1890. In bogs. Closter, New Jersey (*C. F. Austin*). Woodbury, Connecticut (*A. W. E.*). The Woodbury specimens are in a somewhat better condition than those distributed by Austin and may be designated the type.

Pale to bright green, growing scattered among *Sphagna* or forming loose tufts: stems varying from prostrate to ascending or erect, 0.15–0.25 mm. in diameter, cylindrical and composed of undifferentiated cells; vegetative branches few, mostly postical but occasionally lateral: leaves distant to loosely imbricated, slightly convex, spreading at an angle of about 60 degrees, arching partially across the axis, ovate, 0.9–1.2 mm. long, 0.7–0.85 mm. wide, normally rounded and short-decurrent at base but often gradually long-decurrent in poorly developed forms, margin entire or irregularly sinuate, apex rounded, obtuse or more or less bilobed (in very rare cases even trilobed), both lobes and sinus very variable; leaf-cells thin-walled throughout, averaging $40 \times 30 \mu$ at the margin of the leaf and $50 \times 40 \mu$ in median and basal regions, cuticle smooth: underleaves distant, ovate or broadly ovate, 0.45–0.6 mm. long, 0.35–0.5 mm. wide, bifid to the middle or beyond with an obtuse sinus, divisions erect, triangular to subulate, acute to rounded at the apex, mostly six to nine cells long and four to six cells broad at the base, rarely bearing a blunt or sharp supplementary tooth on the outside: inflorescence (so far as known) dioicous: ♂ inflorescence occupying a short branch or terminal on a somewhat longer microphyllous branch; bracts in three to six pairs, closely imbricated, deeply two- to four-lobed; bracteoles small, deeply bifid; antheridia single or in pairs: ♀ inflorescence not seen: gemmae oval, mostly bicellular, with a slightly thickened outer wall, borne in dense masses at the tips of microphyllous stems or branches.

Although the present species is close to *C. Trichomanis*, agreeing with it in several important respects, it can be at once distinguished by its smaller size and more delicate habit, by its variable leaves

showing a strong tendency to be bidentate or bilobed, and by its deeply bifid ovate underleaves. Most of these peculiarities will also separate it from *C. fissa* Raddi, the type of the genus, which is perhaps to be expected in southern New England. This species also has more or less bidentate leaves and deeply bifid underleaves, but the teeth of the leaves are usually sharp, and the underleaves are considerably broader than long.

C. tenuis is of about the same size as *C. sphagnicola* and grows in similar localities. Its more widely spreading leaves and its larger leaf-cells, destitute of trigones, will at once serve to separate it. From *C. suecica* it may be distinguished by its loose habit and larger, thin walled cells. Although *C. tenuis* does not agree with any of the recent European segregations from *C. Trichomanis*, its detection in Europe would not be surprising.

10. CALYPOGEIA TRICHOMANIS (L.) Corda. The range of the present species extends across northern Asia, Europe and North America. Throughout this wide territory it is abundant nearly everywhere and has already been reported from each of the New England states. In its most typical condition it is found on soil rich in humus, either on shaded banks or in the woods. Under these circumstances the plants are more robust than in any of the preceding species, the leaves often attaining a length of 2 mm. and a width of 1.5 mm. Such leaves are imbricated and ovate, spreading from the stem at an angle of about 60 degrees; they are either rounded or very obtuse at the apex and at the base are straight and slightly or not at all decurrent. The underleaves are orbicular and close together but rarely imbricated; they attain a maximum length of about 1 mm. and are bifid one fourth or less with rounded divisions and a shallow, usually rounded, sinus. At the base they are more or less decurrent and are attached by an arched line; supplementary lobes on the sides are wanting or very infrequent. The leaf-cells average about $50 \times 40 \mu$ but vary considerably both in form and in size. Their walls are thin throughout or very slightly thickened and do not show distinct trigones.

When the species grows on sandy soil or in very wet places some of the characters which have just been described show themselves to be unstable. The leaves, for example, tend to become long-decurrent and sometimes show indications of apical teeth, while the underleaves tend to become smaller, more deeply bifid and with sharper divisions.

It is often a question whether these aberrant plants actually represent forms of *C. Trichomanis*, or whether they may not be worthy of specific recognition. The tendency at the present time, as shown by the publication of such species as *C. sphagnicola*, *C. suecica* and *C. tenuis*, is to adopt the latter view, and it is probable that further segregations from *C. Trichomanis* will be made in the near future.

11. SCAPANIA APICULATA Spruce, Ann. & Mag. Nat. Hist. II. 4: 106. 1849. *Martinellia apiculata* Lindb.; Lindberg & Arnell, Kongl. Svenska Vetensk.-Akad. Handl. 23⁵: 32. 1889. On log in river; Chocorua, New Hampshire, August, 1906 (*W. G. Farlow*). This rare species was originally collected by Spruce on the French side of the Pyrenees, and for many years no other localities were reported. At the present time, according to Müller,¹ it is known from Norway, Germany, Switzerland and Siberia, as well as from France. He also quotes a single North American station, North Elba, New York, where Peck² collected the plant less than ten years ago. Chocorua is therefore the second locality recorded for North America. The species was found, however, by Macoun, as long ago as 1881, at Manitoba House, Manitoba, although it is not mentioned in his Catalogue of Canadian Plants. *S. apiculata* is one of the few species of the genus which grow on rotten logs. It bears a certain resemblance to small forms of *S. umbrosa*, which sometimes grows in similar localities. In *S. apiculata*, however, the leaves are entire, and their antical lobes spread obliquely instead of being suberect. Both lobes are either acute or apiculate. The leaf-cells average about 18 μ in the middle of the postical lobe and are characterized by distinct and often conspicuous trigones. The cuticle is said to vary from smooth to minutely verruculose, but the latter condition prevails in American specimens. The perianth is entire at the mouth or very slightly crenulate from projecting cells. The species frequently reproduces by means of gemmae, which present a characteristic appearance. They occur in dense masses at the tips of leaves which are somewhat reduced in size but otherwise scarcely modified. The gemmae themselves are oval in form and unicellular, and their walls are deeply pigmented with brown or purple. They resemble the bicellular gemmae found in *Sphenolobus exsectus*, but this species may be at once distinguished by the smaller and often tooth-like antical

¹ Nova Acta Acad. Caes. Leop. Carol. 83: 265. 1905.

² Bull. N. Y. State Mus. 6: 178. 1899.

lobes of its leaves, and by its smaller leaf-cells with indistinct trigones. Apparently the nearest ally of *S. apiculata* in North America is *S. glaucocephala* (Tayl.) Aust., which has been reported from New England without definite stations. In this species the gemmae are usually unicellular and are very similar to those just described. They are found, however, on modified flagelliform shoots bearing small and distant leaves. The normal leaf-cells are of about the same size as in *S. apiculata*, but their trigones are minute and scarcely evident. On the gemmiparous branches the cells which give rise to the gemmae are much larger than the others and show strongly thickened walls, but even here there are no distinct trigones. *S. apiculata* should be looked for in other parts of New England, especially in mountainous regions.

12. FRULLANIA TAMARISCI (L.) Dumort. The relationship between the present species and *F. Asagrayana* Mont. is so close that it is very difficult to draw a line of demarcation separating them. In the writer's Revision of the North American Species of *Frullania*,¹ certain characters derived from the basal auricles of the underleaves and from the lobules of the leaves and bracts are emphasized as differential. In *F. Tamarisci*, for example, the auricles of the underleaves and the large stylus of the lobule are described as crispate, while the lobules of the bracts are said to bear clusters of fine cilia at the base instead of distinct segments. In *F. Asagrayana*, on the other hand, the auricles (even when present) and the styluses are said to be never crispate, while the basal segments of the bracteal lobules are described as being well developed. In a recent letter Mr. S. M. Macvicar, of Invermoidart, Scotland, has called attention to the fact that these differential characters are by no means constant. In support of his statement he has kindly communicated specimens of a Scotch form of *F. Tamarisci* in which the underleaves and the lobules of the ordinary leaves are essentially like those in *F. Asagrayana*, and in which the lobules of the bracts bear distinct basal segments. That this form belongs to *F. Tamarisci* and not to *F. Asagrayana* is shown by the sharply pointed leaf-lobes and by the more or less irregular arrangement of their ocelli, the lobes in *F. Asagrayana* being normally rounded at the apex and developing ocelli in a nerve-like row. Apparently these slight and relative differences are all that remain to distinguish the two species, and it becomes a question whether to

¹ Trans. Conn. Acad. 10: 27. 1897.

consider *F. Asagrayana* distinct or simply one of the extremes of a very variable species, the other being the robust normal form of *F. Tamarisci*. The first course seems to be still justifiable on account of the fact that no European forms of *F. Tamarisci* are known which exactly correspond with any of the American forms of *F. Asagrayana*. *F. Tamarisci* is a comparatively rare species in North America, and the following are the only New England stations known to the writer: Prospect Harbor, Maine (*Mrs. Northrop*); Blackstone, Rhode Island (*J. L. Bennett*); Seymour, Connecticut (*A. W. E.*). It has also been reported from Massachusetts.

The following represent additions to local state floras, not included in the preceding notes: *Frullania Brittoniae*, Buckfield, Maine (*J. A. Allen*); *Lophozia excisa*, North Haven, Connecticut (*A. W. E.*)¹; *L. porphyroleuca*, Willoughby, Vermont (*Miss Lorenz*) and Stafford, Connecticut (*G. E. Nichols*); *Odontoschisma denudatum*, Buckfield, Maine (*J. A. Allen*); *Sphenolobus minutus*, Mount Mansfield, Vermont (*Miss Lorenz*). The Maine record for *Riccardia palmata* and Rhode Island records for *Grimaldia fragrans*, *Reboulia hemisphaerica*, *Riccardia sinuata*, and *Geocalyx graveolens*, marked in the writer's Preliminary List with the sign "—" may now be marked with the sign "+", the necessary specimens of these five species having been collected and communicated by J. F. Collins.

The census of New England Hepaticae now stands as follows:—Total number of species recorded, 141; number recorded from Maine, 88; from New Hampshire, 105; from Vermont, 83; from Massachusetts, 81; from Rhode Island, 64; from Connecticut, 102; common to all six states, 37.

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EXPLANATION OF PLATE 73.

Calypogeia Sullivantii Aust. Fig. 1, part of stem, postical view, $\times 25$; Fig. 2, part of stem, antical view, $\times 25$; Fig. 3, cross section of stem, $\times 55$; Fig. 4, surface view of stem, showing parts of four leaf-bases, $\times 55$; Figs. 5, 6, apices of leaves, $\times 55$; Fig. 7, cells from middle of leaf, $\times 200$; Fig. 8, underleaf, $\times 200$. The figures were all drawn from specimens collected by the writer at Atsion, New Jersey, and distributed in *Hep. Amer. 156* (as *Kantia Sullivantii*).

Calypogeia tenuis (Aust.) Evans. Fig. 9, part of stem, postical view, $\times 25$; Fig. 10, part of stem, antical view, $\times 25$; Fig. 11, slender stem, postical view, $\times 25$; Fig. 12, cross section of stem, $\times 55$; Fig. 13, cells from middle of leaf, $\times 200$; Fig. 14, gemma, $\times 265$. The figures were all drawn from the type specimen.

¹These specimens have already been recorded and figured by Miss Haynes in the *Bryologist* 9: 99. *pl. 9, f. 10-13.* 1906.